Delta Stewardship Council

Presentation to the Delta Independent Science Board
Delta Plan Performance Measures

February 11, 2016

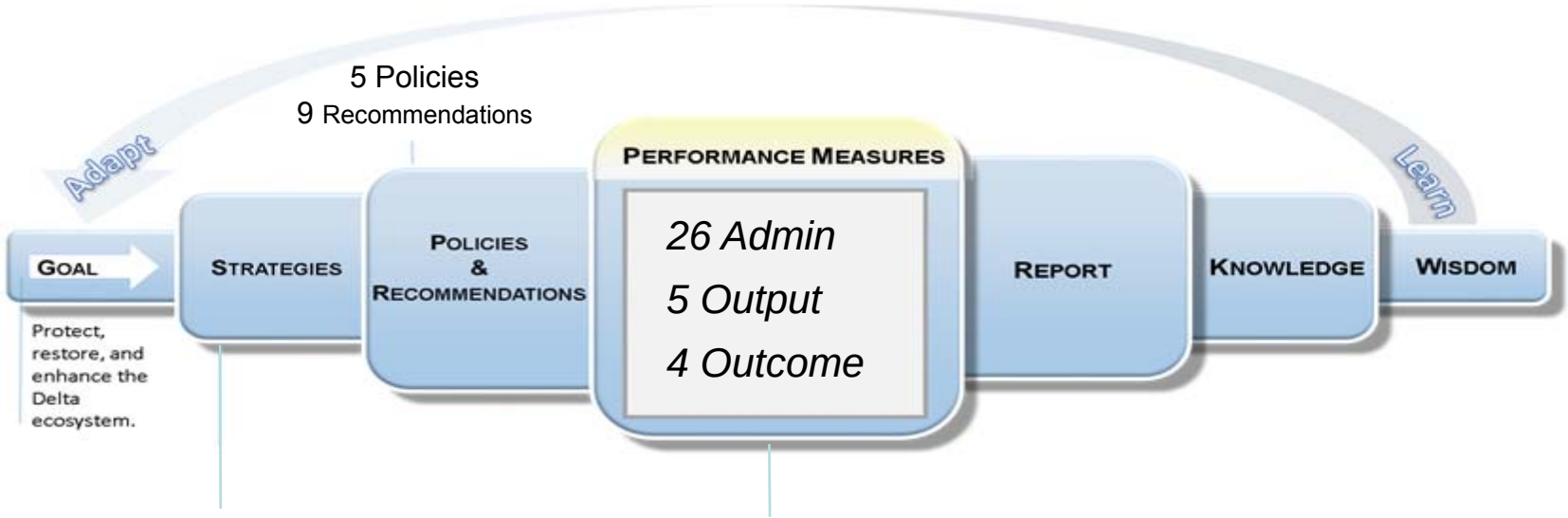
Purpose

Walk through the process using a specific example:

- **Restoring Functional Flows**

Delta Plan Chapter 4: Ecosystem Restoration

At-a-Glance



Strategies

1. Create more natural functional flows
2. Restore habitat
3. Improve water quality to protect the ecosystem
4. Prevent introduction of and managing nonnative species impacts
5. Improve hatcheries and harvest management

Output/Outcome Measures

- Number of acres of habitat restored
- Measured progress toward BiOps restoration targets
- Progress toward achieving "doubling goal" for wild CV salmonids
- Progress towards restoring in-Delta flows
- Progress toward occurrence & use of protected & restored habitat by native species
- Implement DFW list of "Stage 2 Actions for Non-native Invasive Species"
- Progress towards decreasing trends in number, abundance, and distribution of existing nonnative species
- Adopt Delta flow objectives
- Adopt flow objectives for major tributaries by 2018

Restoring Functional Flows

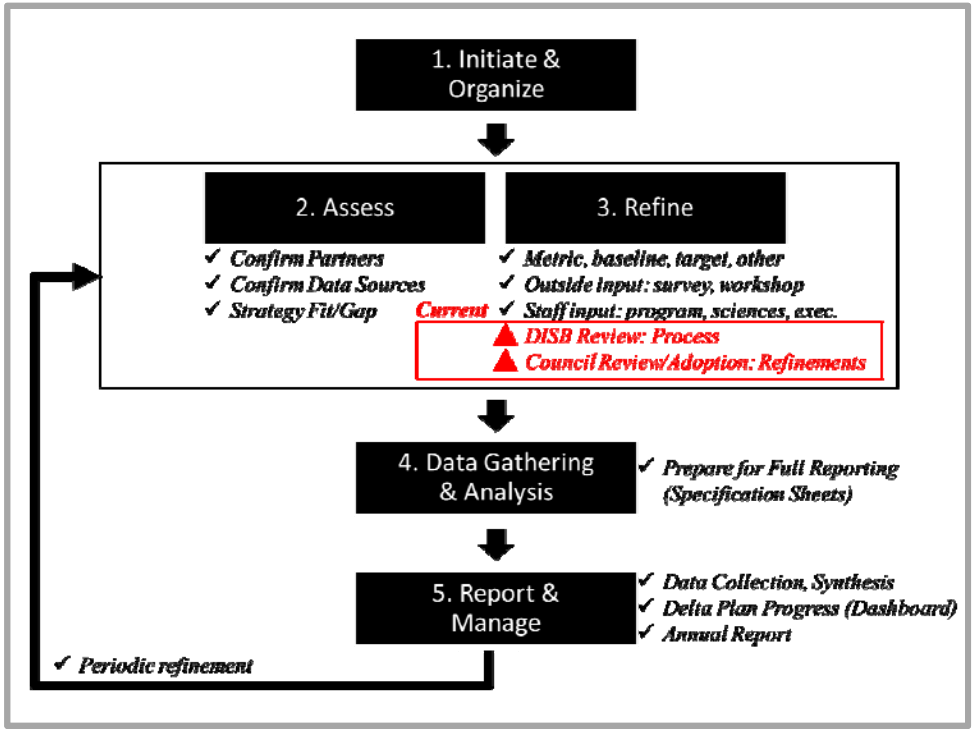
Process Overview

Restoring Functional Flows

Current Delta Plan:
(Broad Performance Statement)

"Progress toward restoring In-Delta flows to more natural functional flow patterns to support a healthy estuary.

Metrics: results from hydrological monitoring and hydrodynamic modeling."



Step 2: Assess

Restoring Functional Flows

► Perform research: identify and confirm data sources/partners

DELTA INTERAGENCY
COLLABORATIVE EFFORTS RESEARCHED
(representative sample)

Collaborative Working Groups

- CA Water Quality Monitoring Council (CWQMC)
- CA Estuary Monitoring Workgroup (CEMW)
- CA Wetlands Monitoring Workgroup (CWMW)
- Data Management Group
- Healthy Streams Partnership
- San Francisco Estuary Partnership (SFEP)

Relevant Research (Flows)

- Est. ecologically based flow targets
- Natural Flow Regime ~ Restoring native fish assemblages.
- Natural Flow Regime ~ River Conservation and Restoration.
- Method for Assessing Hydrologic Alteration within Ecosystems.
- Functional Flows in Modified Riverscapes: Hydrographs, Habitats and Opportunities.

Planning and Data Resources

- CA EcoRestore
- CA WaterFix
- Water management plans (urban, agricultural)
- State of the Estuary Report (SotER)
- Bay Delta Water Quality Control Plan
- Delta Plan
- CA EcoAtlas
- Delta Landscapes Project
- Sac.-SJ Delta Historical Ecological Study
- CA Wetlands Portal (Wetland Tracker)
- Delta Regional Monitoring Program (Delta RMP)
- Delta Economic Sustainability Plan
- Comprehensive Conservation Mgt. Plan (CCMP)

Other Multi-Agency Plans and Programs

- Fish Restoration Program Agreement (FRPA)
- Ecosystem Restoration Program (ERP)
- Central Valley Flood Protection Plan (CVFPP)
- Delta Land Use and Resource Management Plan
- CVRWQCB Water Quality Control Plan
- Delta Science Plan
- Interagency Ecological Program (IEP)
- Environmental Monitoring Program (EMP)
- Delta Vision

Step 2: Assess

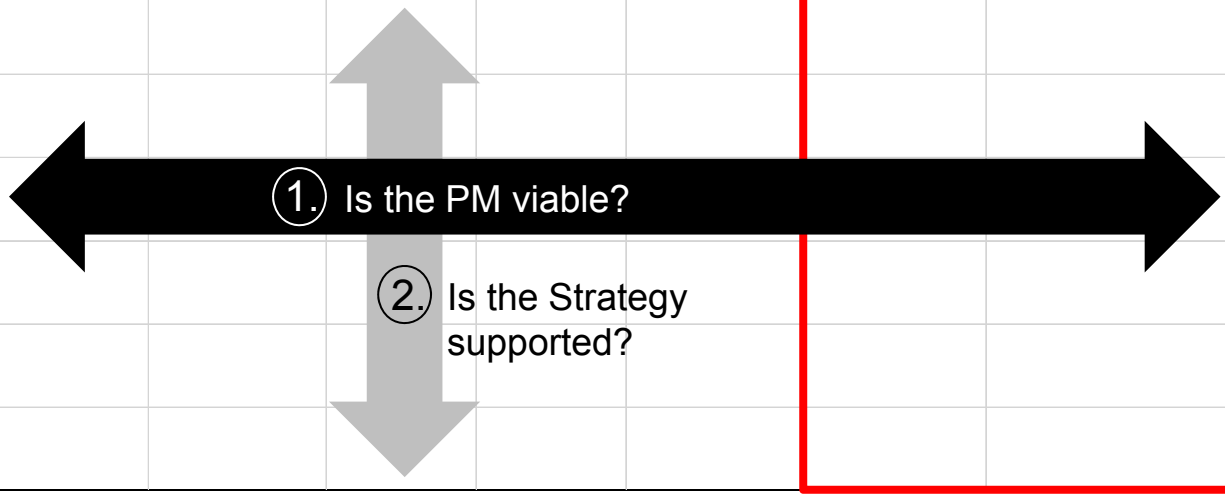
Restoring Functional Flows

- **Evaluate how well the performance measures fit strategies (strategy fit/gap)**

Delta Plan Chapter X

Collaboration

Output/Outcome Performance Measure		(I) Strategy Alignment Rating					(II) Implementation Rating		Average
		Strategies, Policies & Recommendations (per Delta Plan)					Readiness	Feasibility	
		Stategy #1	Stategy #2	Stategy #3	Stategy #3	Stategy #5	H: little refinement needed M: some L: significant	H: good process alignment, low risk M: some alignment and risk L: poor alignment, high risk	
		Policy 1 Recommendation 1 Recommendation 2	Policy 2 Recommendation 3 Recommendation 4	Recommendation 5 Recommendation 6	Recommendation 7 Recommendation 8	Recommendation 9 Recommendation 10 Recommendation 11			
output	**PM #1**								
output	**PM #2**								
outcome	**PM #3**								
outcome	**PM #4**								
outcome	**PM #5**								
outcome	**PM #6**								



3. Is the Chapter adequately supported?

Step 2: Assess

Restoring Functional Flows

- **Evaluate how well the performance measures fit strategies (strategy fit/gap)**

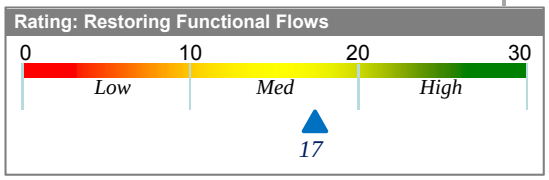
Delta Plan Chapter 4

Collaboration

Output/Outcome Performance Measure		(I) Strategy Alignment Rating					(II) Implementation Rating		Average
		Strategies, Policies & Recommendations (per Delta Plan)					Readiness	Feasibility	
		Stategy #1	Stategy #2	Stategy #3	Stategy #3	Stategy #5	H: little refinement needed M: some L: significant	H: good process alignment, low risk M: some alignment and risk L: poor alignment, high risk	
		Create more natural functional flows	Restore Habitat	Improve Water Quality	Prevent/ manage non-native	Hatcheries, Harvest mgmt.			
Outcome	Restoring functional flows	30	20	20	20	20	20	10	17

"Progress toward restoring In-Delta flows to more natural functional flow patterns to support a healthy estuary.

Metrics: results from hydrological monitoring and hydrodynamic modeling."



* *High (30 points), Medium (20), Low (10)*

Step 2: Assess

Restoring Functional Flows

- **Evaluate how well the performance measures fit strategies (strategy fit/gap)**

Current Perf. Measure:
(1 broad measure)

"Progress toward restoring In-Delta flows to more natural functional flow patterns to support a healthy estuary.

Metrics: results from hydrological monitoring and hydrodynamic modeling."

Research & Document

- Reports
- Science Program
- Other Partners
- Key PM components:
  - ✓ Metrics
  - ✓ Baseline
  - ✓ Target
  - ✓ Data Source

Strategy Fit/Gap

Strategy #1: "Create more natural functional flows"

- Strategy: ***Medium (Avg. 22 pts)***
- Feasibility: ***Medium (20 pts)***
- Readiness: ***Low (10 pts)***
- Overall score: ***Med-Low (17 pts)***

Draft Recommendation:
(3 sub-measures)

1. Yolo Bypass
2. Recession Flows
3. Spring Pulse Flows

Step 3: Refine

Sub-Measure: Spring Pulse Flows

- **Obtain input**

Proposed Delta Plan Wording and/or Reclassification

Progress toward restoring more natural functional flow patterns to support a healthy estuary, including flow patterns to support ecological floodplain processes in the Yolo Bypass, spring pulse flows along the Sacramento River, and more gradual recession flows at the end of the wet season.

Metric:

- Frequency of achieving >17,000 acres of inundation for 14 or more consecutive days in the Yolo Bypass.
- Flows exceeding base flows. A flow, e.g. 5 to 10 times greater than the base flow, during the period of Spring flows.
- Rate of change in the hydrograph on the receding limb as measured from Spring high flows to Summer low flows.

Baseline:

- Between 1984 and 2007 the Bypass flooded intermittently, only meeting 2009 National Marine Fisheries Service (NMFS) Biological Opinion requirements for 14 consecutive days of floodplain inundation between December and April once every 10 years.
- Long-term historical hydrograph data retrieved from USGS stations from below Shasta.

Target:

- Allow for >17,000 acres of Yolo Bypass inundation for 14 or more consecutive days between December and March in at least two out of three years.
- At least one spring flow event 5 to 10 times winter base flow each year.
- Not to exceed daily drops in flow >10%.

Step 3: Refine

Sub-Measure: Spring Pulse Flows

- **Obtain Delta Science Program input**
- **Obtain outside feedback (survey, workshop)**
- **Obtain Delta Stewardship Council input (Recommendations)**
- **Obtain Delta Independent Science Board input (Process)**

★**You are here**

- **Obtain Delta Stewardship Council approval to proceed**

Step 3: Refine

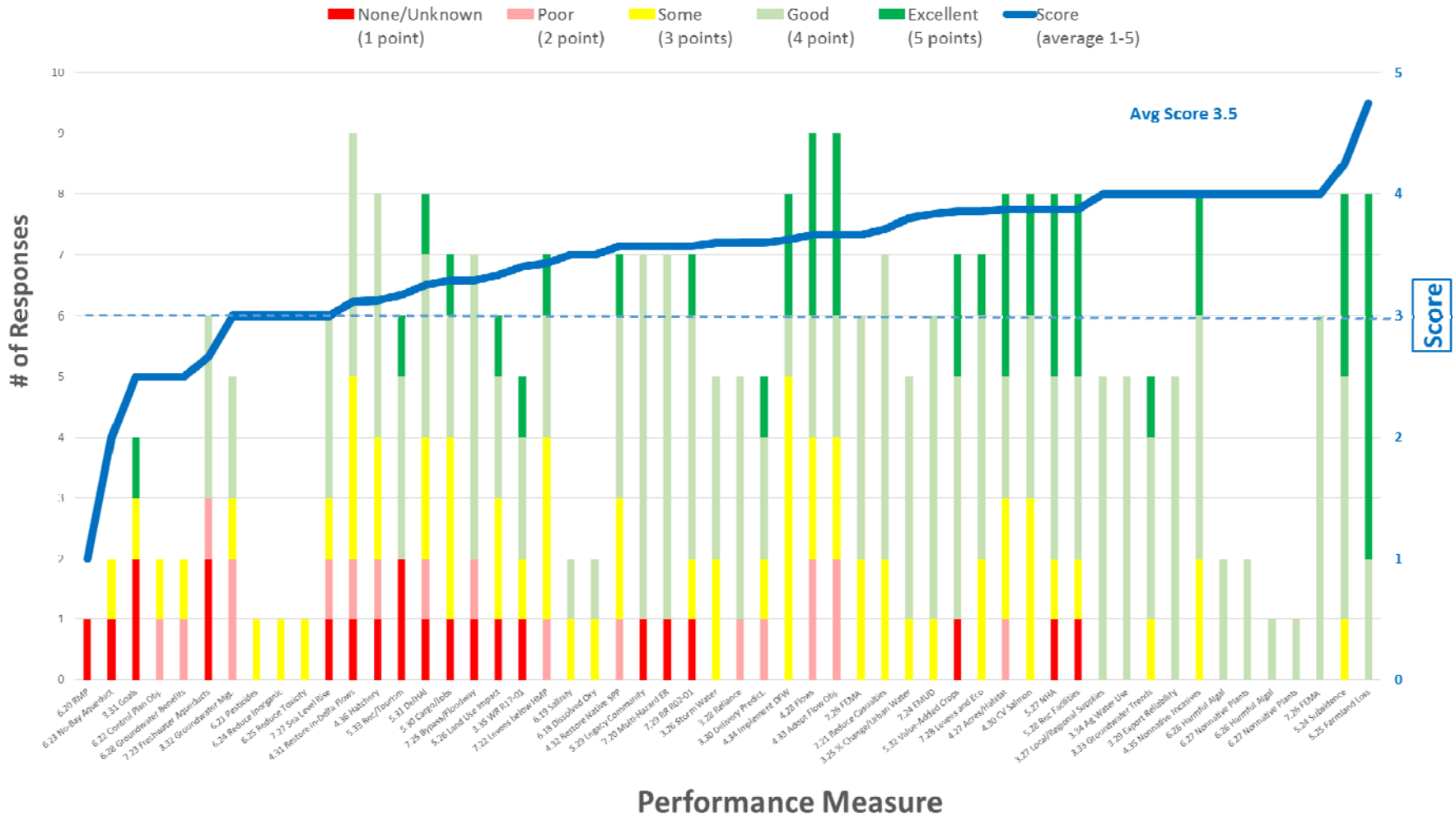
By the numbers…

- **Online Survey**
  - 65 invitees
  - 34 provided input/rating
  - 35 additional reviewed only
  - Rating results: see next slide
- **Public Workshop**
  - 17 attended onsite
  - 17 additional remote (WebEx)
- **Internal Input**
  - 16 internal review meetings held (program, science, mgt. staff)
- **Council Staff Reports**
  - 2014: 2
  - 2015: 2
  - 2016: 2 to date
- **Refinement recommendations**
  - 41 output/outcome measures in Delta Plan
  - 8 added
  - 6 reclassified to administrative measures
  - 6 removed
  - 37 currently proposed for Council adoption, with the inclusion of metrics, baselines, and targets for each.

Step 3: Refine

By the numbers…

- **Online Survey** (visual portrayal of rating analysis performed)



Step 3: Refine

Sub-Measure: Spring Pulse Flows

- **Expand Data Specification**

I. Core Criteria	**V. Notes**
II. Decision Support	**VI. Presentation Reporting**
III. Data	**VII. Assumptions/Conceptual Model**
IV. Process	**VIII. Conclusion**

(walk through specification document)

Steps Looking Ahead

Sub-Measure: Spring Pulse Flows

- **Step 4:**
  - Collect Data
  - Synthesize/Analyze Information
- **Step 5:**
  - Implementation Reporting
  - Periodic Refinement

Discussion

Thank you!

PM Specification Cover Sheet

Sub-performance Measure: Spring Pulse Flows

Chapter: 4

DSC Lead: Megan Brooks and Dan Constable

Comments/Actions Blog:

Ref	*Date*	*Name*	*Comment/Action*	*Open/Closed*
1	*15 Dec '15*	*Daniel Constable*	*Draft 1*	*Open*
2	*7 Jan '16*	*Daniel Constable*	*Copied into updated PM Spec format*	
3	*11 Jan '16*	*Megan Brooks*	*Edits*	
4	*12 Jan '16*	*Daniel Constable*	*Edits*	
5	*12 Jan '16*	*Megan Brooks*	*Edits and review*	
6	*2 Feb '16*	*Cliff Dahm*	*Edits and review*	
7	*3 Feb '16*	*Megan Brooks and Dan Constable*	*Edits*	*Closed*
8				
9				
10				
11				
12				
13				
14				

Sub-performance Measure: Spring Pulse Flows

I. Performance Measure (PM) Component Attributes	
Type: Outcome	
Delta Plan Description:	Progress toward restoring in-Delta flows to more natural functional flow patterns to support a healthy estuary. Metrics: results from hydrologic monitoring and hydrodynamic modeling.
Wording Change or New PM:	Progress toward restoring more natural functional flow patterns to support a healthy estuary including flow patterns to support ecological floodplain processes in the Yolo Bypass, spring pulse flows along the Sacramento River, and more gradual recession flows at the end of the wet season.
Sub-performance Measure:	Spring pulse flows along the Sacramento River.
Metric:	Flows exceeding base flows. A flow, e.g. 5 to 10 times greater than the base flow, during the period of Spring flows.
Expectation:	Larger-magnitude peak flows ("pulse flows") support key ecological processes and help create more functional natural habitat. Restoring or maintaining high flow pulses in the Sacramento River in Spring will help meet the goal of "protecting, restoring, and enhancing the Delta ecosystem", while continuing to allow for beneficial human use. These seasonal high pulse flows provide important functions that support a wide range of native aquatic and riparian species, which depend on such flows for behavioral cues, creation or maintenance of habitat critical to their survival, and connecting river and floodplain habitat.
Baseline:	Long-term historical hydrograph data retrieved from U.S. Geological Survey/U.S. Bureau of Reclamation (USGS/USBR) stations from along the Sacramento River and below Shasta Dam. A one-hundred-year (1906-2006) hydrologic record from Bend Bridge, below Shasta Dam, shows that after dam construction spring pulse flows have been reduced: wet year median spring peak flows here have decreased from above 5,500 Cubic Feet per Second (CFS) pre-Shasta, to less than 2,500 CFS post-Shasta (Cain and Monohan 2008).
Reference Condition (if applicable):	Pre-dam flow regime with range of Spring flow patterns, including pulse flows, that serve key ecological functions for riverine and riparian habitats and associated species.
Target:	At least one spring flow event 5 to 10 times winter base flow each year.
Spatial:	USGS gage stations along the Sacramento mainstem.

I. Performance Measure (PM) Component Attributes	
Readiness/ Feasibility:	1) Readiness: *High* Historical and current data available from USGS. 2) Feasibility: *High* Discharge data used to calculate pulse flows is monitored. There are no significant risks foreseen to the sub-performance measure.
Variations:	Number of pulse flows above base flows at least 24 hours in duration occurring during spring.
Conceptual Relevance:	Metric is relevant to Delta Plan goals to restore "in-Delta flows to more natural functional flow patterns…" Pulse flows are a key component of functional flows arriving to the Delta, and are the focus of this sub-performance measure metric.
Responsiveness:	This measure captures pulse flows, as measured by discharge data. The data are highly temporally responsive and can capture small changes in flow.
Interpretation:	Measure provides an objective figure that demonstrates progress towards more natural in-Delta flow restoration goals by addressing flows in Spring from the major tributary and informs management decisions.
Transferability:	The measure is scalable, and can be implemented in most locations that have a river gage. Although it will initially focus on stations along the lower Sacramento River, it could later be expanded to cover other rivers and in Delta flows.

II. Basis for Selection

1) Overall Purpose: This metric will support Delta Plan policies on improving more functional flow regimes. Pulse flows during the wet season have been shown to have wide-ranging effects on ecosystem health and are important for many species of concern along the Sacramento River below Shasta Dam. This metric will help track progress towards sustaining or enhancing pulse flows that support these factors.

2) Emphasis: This sub-performance measure was selected due to the importance of spring pulse flows and because it does not depend as heavily on State Water Resources Control Board (SWRCB) water quality objectives. As an interim metric, spring pulse flows along the Sacramento River below the Shasta Dam will be monitored. This metric could later be implemented along select priority tributaries, to be identified by the SWRCB as part of its flow criteria development process.[1]

3) Management decisions supported:
   a) Are we progressing towards restoring flows on the lower Sacramento River to more natural functional flow patterns?
   b) Are we on track to meet SWRCB flow objectives?

Linkage to:

Delta Plan and Coequal Goals:	✓ Good	1) Legislative mandates: a) 85211: "The Delta Plan shall include performance measurements that will enable the council to track progress in meeting the objectives of the Delta Plan. The performance measurements shall include, but need not be limited to, quantitative or otherwise measurable assessments of the status and trends in all of the following: (a) The health of the Delta's estuary and wetland ecosystem for supporting viable populations of aquatic and terrestrial species, habitats, and processes, including viable populations of Delta fisheries and other aquatic organisms." b) 85302(c)(1) through 85302(c)(5): " The Delta Plan shall include measures that promote all of the following characteristics of a healthy Delta ecosystem: (1) Viable populations of native resident and migratory species; (2) Functional corridors for migratory species; (3) Diverse and biologically appropriate habitats and ecosystem processes; (4) Reduced threats and stresses on the Delta ecosystem; (5) Conditions conducive to meeting or exceeding the goals in existing species recovery plans and state and federal goals with respect to doubling salmon populations." 2) Achieve coequal goals: Restore the Delta ecosystem. 3) Address DP core strategies: Create more natural functional flows.

[1] As part of Phase 4 of Comprehensive Bay-Delta Effort "The State Water Board intends to develop flow criteria, flow objectives, and associated implementation plans for a minimum of five priority tributaries in the Bay-Delta watershed by 2018 and for the remaining priority tributaries thereafter. State Water Board staff is consulting with the fisheries resource agencies in the development of the Sacramento-San Joaquin Delta priority tributaries."
http://www.swrcb.ca.gov/waterrights/water_issues/programs/bay_delta/flow_objectives/index.shtml

II. Basis for Selection		
The Council Priorities:	✓ Good	The 2015 Council management priorities clearly aligned with this performance measure and its sub categories, and "Encourage more natural functional flows of fresh water into and through the Delta and ensure use of best available science in forums where flows are determined." Provisional 2016 priorities highlight support for development of flow performance measures and integration of flows and relevant work in the Delta.
Project Types:	✓ Good	☐ Acquisition ☐ Education/Outreach ☐ Infrastructure Improvement ☒ Monitoring ☐ Planning ☒ Research ☒ Restoration ☐ Unknown or not applicable
Other:	✓ Good	*Opportunity to align with other efforts, such as:* 1) SWRCB update of flow objectives and criteria: Delta Watershed Flow Objectives (Phase 4 of Bay-Delta Effort) 2) National Marine Fisheries Service (NMFS) biological opinion 3) U.S. Fish and Wildlife Service (USFWS) Anadromous Fish Restoration Program 4) USFWS Instream Flow Annual Reports 5) Central Valley Flood Protection Plan

III. Source of Information	
Data Adequacy:	Data is easily obtainable from online California Data Exchange Center (CDEC) database or USGS's water data, and is reliably and accurately measured. It is fully adequate for this metric.
Primary:	1) Primary 1: a) Source/report name and owner: Discharge data from USGS/USBR gage stations below Shasta Dam (e.g. http://waterdata.usgs.gov/nwis/uv?site_no=11377100). b) Format: Electronic Comma Separated Value (CSV), graphs, and/or charts. c) Content: Discharge (flow) measurements (derived from stage data). d) Update frequency: Data will be reported on a monthly and seasonal basis, highlighting major pulse events throughout the wet period.
Alternative:	1) Alternative 1: a) Source/report name and owner: Select USGS/USBR gage stations along the Sacramento River below Shasta Dam. b) Format: CSV, graphs, and/or charts. c) Content: Water temperature and turbidity. These variables also affect aquatic habitat conditions. If used, these variables should be considered as supporting metrics, and not serve as a stand-alone alternative to pulse flow. Salinity could also be measured if this measure expanded to cover areas within the Delta. d) Update frequency: Variable, depending on gage station; often 15 minute intervals. 2) Alternative 2: a) Source/report name and owner: CDEC Flows and River Discharge. http://cdec.water.ca.gov/cdecstation/. b) Format: CSV, graphs, and/or charts. c) Content: Discharge flow measurements. d) Update frequency: Data is reported on a monthly and annual basis.
The Council's Role:	1) Role: Review best available scientific research on functional pulse flows and offer comments on SWRCB flow objective updates, as necessary. 2) Dan Constable, daniel.constable@deltacouncil.ca.gov.

IV. Process

The Council will synthesize and report data provided by USGS to help inform progress towards attainment of the coequal goals.

Stages:

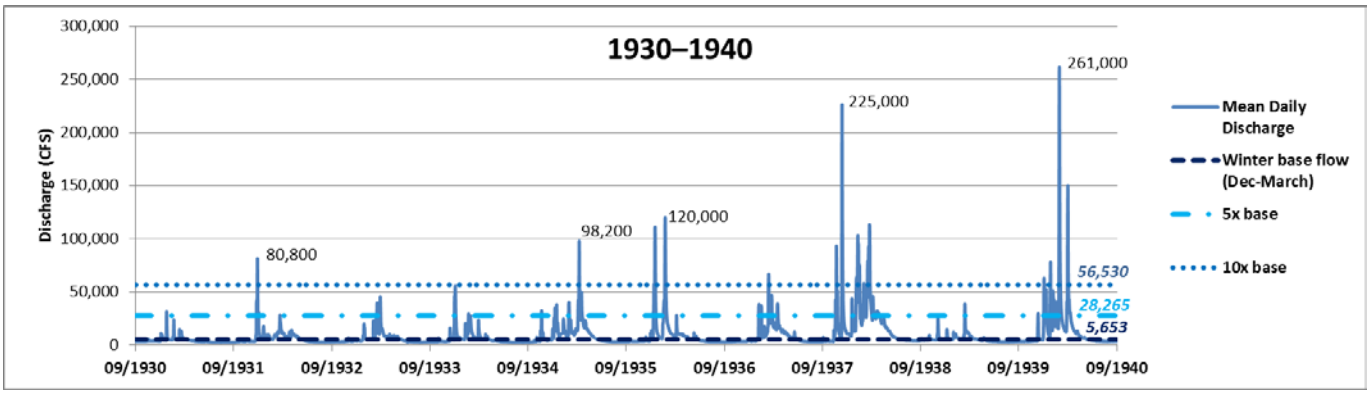
1) Data Collection	The Council will collect spring discharge data from USGS, as noted in section three.
2) Analysis/Synthesis	1) The Council will compile spring discharge data and analyze pulse flows, e.g. 5–10 times base flows. 2) The Council will develop graphs/charts of pulse flows for the Sacramento Rivers below Shasta Dam. 3) Council staff will work with partners to research and monitor outcomes for pulse flows and effects on habitat and select aquatic species.
3) Reporting on PM	The Council is responsible for reporting on this measure through various means, i.e. annual reporting processes, website, and various information releases.

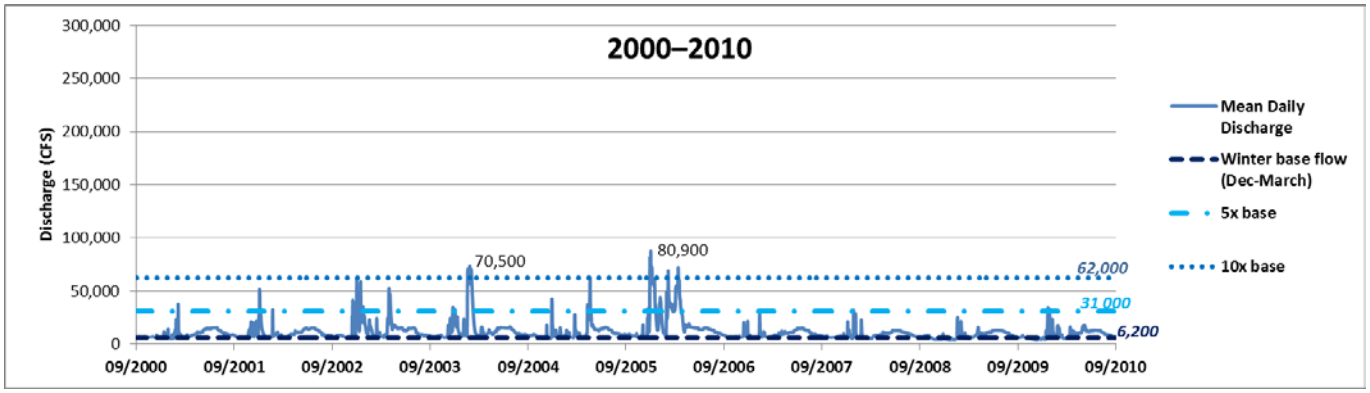
V. Notes	
1) Process Risks, Deficiencies and/or Dependencies	1) Process risks: Limited risk anticipated. Metric is based on data that is already monitored and publicly available. 2) Deficiencies: a) Restoring more functional pulse flows on regulated rivers depends on ability to release appropriate flows through existing water control structures and from flows from unregulated streams and rivers. This will influence and may be limited by requirements for water storage, flood control, recreational activities, and downstream water users. b) Large pulse flows may not be as functional for all species as multiple, slightly smaller pulse flows throughout spring. This metric does not account for this. c) Pulse flows should be considered in concert with flow recession rates, water temperature, and other relevant variables influencing ecosystem health. Not all of these are measured at all USGS gage stations. 3) Dependencies: Reporting of this measure is dependent on USGS monitoring data.
2) Council-Specific Impacts, Implications	The Council's Program Performance Management Office unit will be primarily responsible for the data analysis and reporting.
3) Key Council Actions Needed for Success	Close coordination with SWRCB. Outcome monitoring coordination with academic researchers, USFWS, California Department of Fish and Wildlife, NMFS, local stakeholders.
4) Other	Monitoring should initially focus on the Sacramento River below Shasta Dam. Later, tributaries could be selected from the SWRCB priority tributary list with an initial focus on dammed/managed rivers.

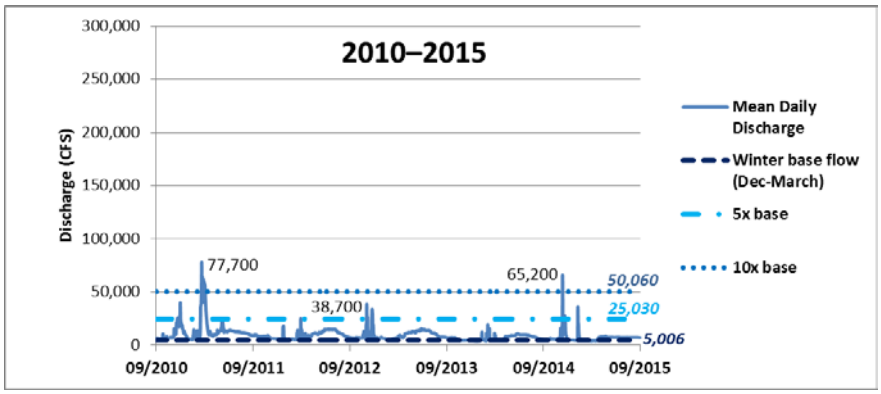
VI. Presentation/Reporting

Maps, charts and graphs presenting spring pulse flow. Data will be compiled weekly and reported monthly during spring. Data will also be analyzed and reported seasonal.

Qualitative:	This sub-performance measure will help measure and communicate progress towards the Delta Plan objectives of improved more natural flows.
Quantitative/charts:	Charts and graphics will be used to communicate progress towards more natural pulse flows in the Sacramento rivers.





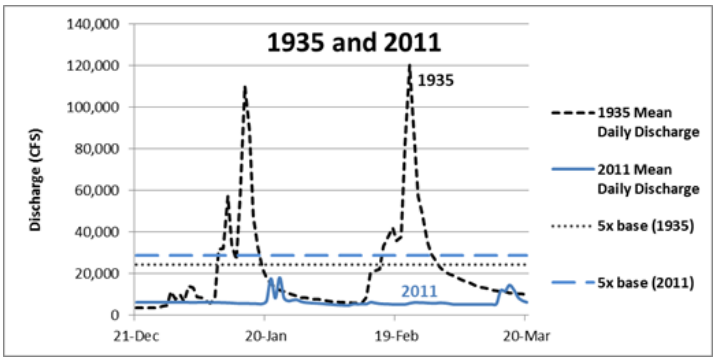


Winter base flow, decadal averages

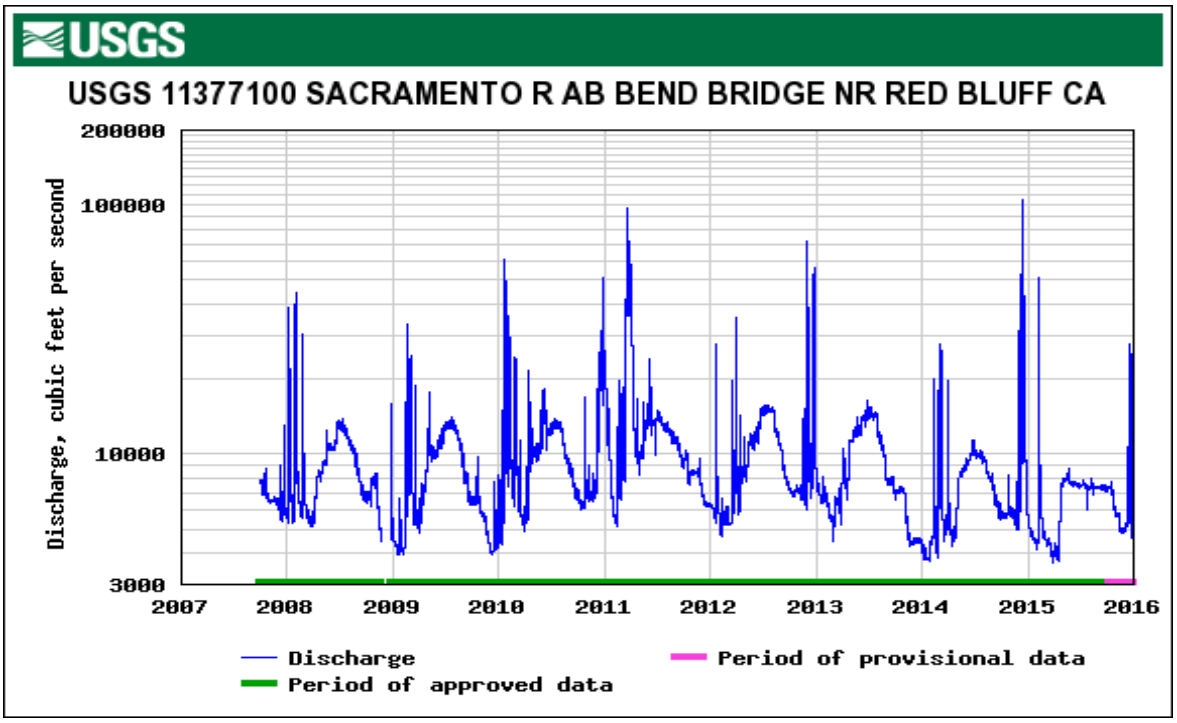
Year	CFS
1930–40	5,353
2000–10	6,200
2010–15	5,006

The above charts show average daily discharge for the years 1930–1940, 2000–2010, and 2010–2015. Average winter base flow (21 December-20 March) has been overlaid for the corresponding 5- or 10-year periods illustrated. Base flow is the background discharge between high flow periods, when groundwater contributions dominate. Average winter base flow has fluctuated, but shows no trend in the three time periods shown. Source: Generated by Council staff using USGS data.

VI. Presentation/Reporting



The chart to the left highlights data for 1935 and 2011. In these two years, winter base flows were similar (4,870 CFS in 1935; 5,715 CFS in 2011). However, pulse flows greatly differed. During 2011 and 2013 there were no spring pulse flows above five times winter base flow. Such years could serve as candidates for more natural functional spring pulse flows. Source: Generated by Council staff using USGS data.



Discharge (CFS) for the Sacramento River at Bend Bridge for 2007–2015. Spring pulse flows 5–10 times above Winter base flow will be highlighted and reported by the Council. Reporting will focus on spring months and report total number of pulse events as well as their characteristics (duration, discharge rate of change, and frequency). Source: USGS.

Performance Reporting Mockup:

Key Question(s): Will pulse flows restore habitat within the Sacramento-San Joaquin Delta? Can Spring pulse flows during droughts help maintain native fish populations while meeting human demand?

Why is this important?

Spring pulse flows are critical for aquatic and riparian health. Such pulse flows can serve as a cue for migration of salmon, as well as scour excess sediment from potential salmon redds, disperse plant seeds, flush nutrients downstream, and provide a more favorable environment for native species. The magnitude and recurrence frequency of spring pulse flows on the Sacramento Rivers has decreased since construction of reservoirs and other diversion structures upstream (Cain and Monohan 2008; Yarnell et al. 2010).

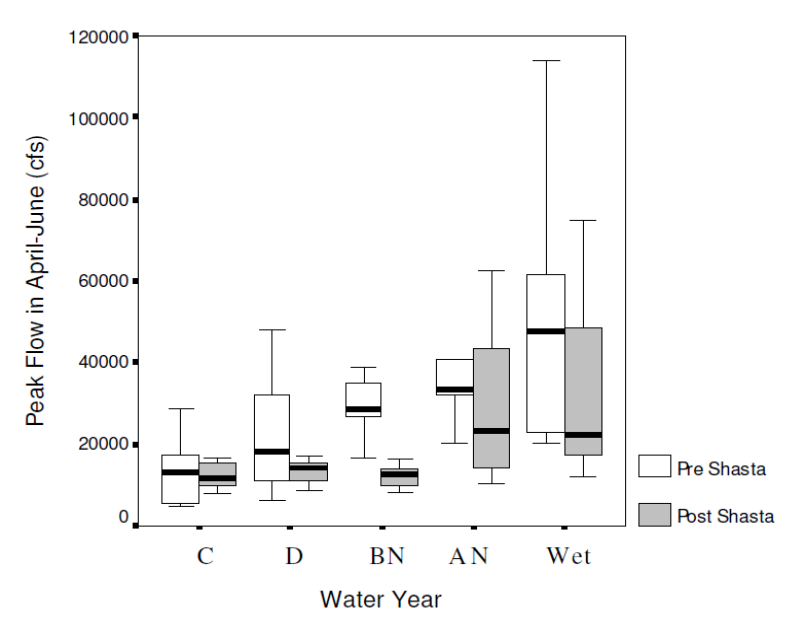


Figure 1. **Peak flow in April through June at Bend Bridge, by water year type: C = Critically Dry, D = Dry, BN = Below Normal, AN = Above Normal. Spring flows and variability have decreased since the construction of Shasta Dam, most notably in the driest years.** ***Source: Cain and Monohan, 2008.***

How is progress tracked?

Discharge can fluctuate interannually, seasonally, daily, and intradaily. The latter can be influenced by snowmelt and hydropower or reservoir operations. This metric will use daily discharge data to track progress towards more natural pulse flows, e.g. 5-10 times the winter base flow, during the Spring wet season.

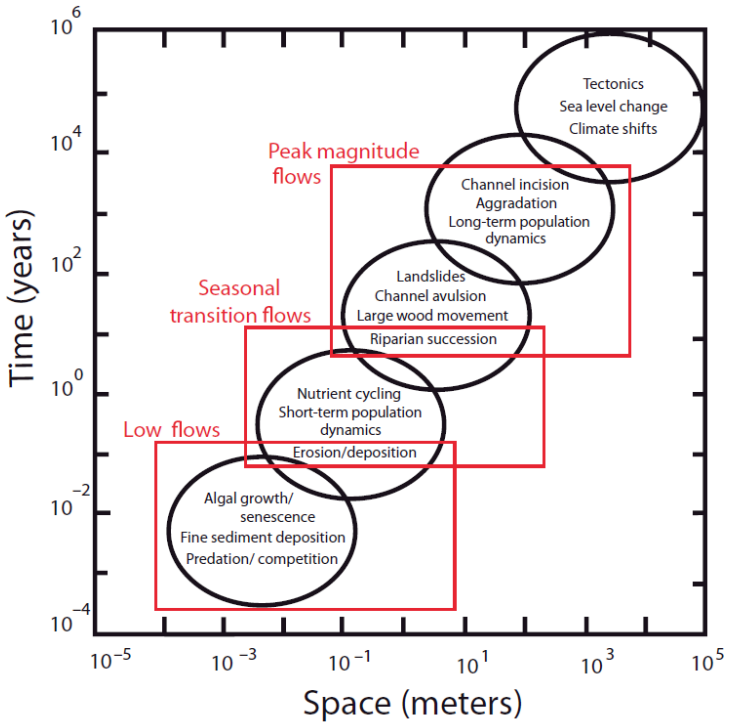
What do the results tell us?

The results show the magnitude, recurrence, and timing of spring pulse flows on a daily basis, and for the period of record of interest. This information serves as a proxy for riverine and riparian habitat health. The results of this measure, when combined with field studies, will help quantify progress towards more natural flows and accompanying improvements to functional ecosystems along the Sacramento River and within the Sacramento-San Joaquin Delta.

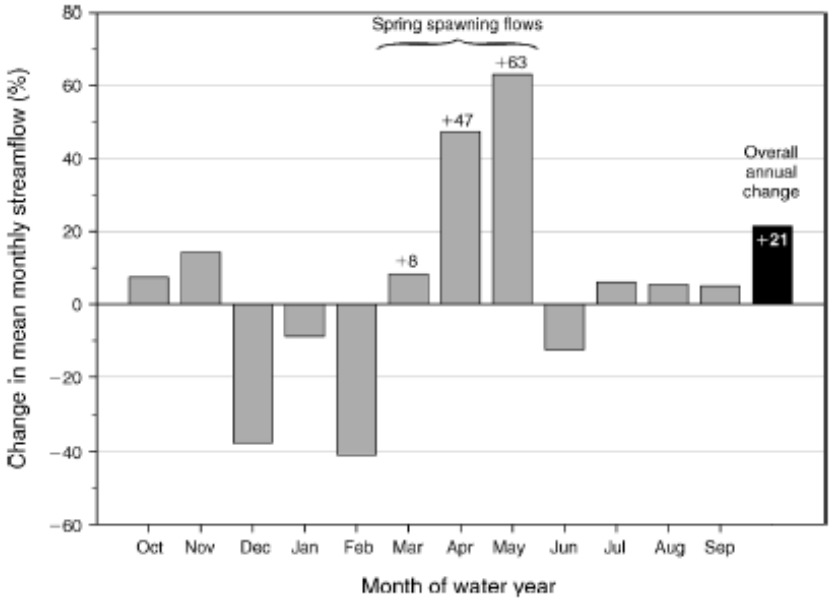
VII. Assumptions

1) Flow data is assumed to remain readily available and reported out on a monthly basis.
2) USGS is assumed to provide best available data by utilizing gage stations along the Sacramento River below Shasta Dam.

Conceptual Model:



Function and scope of pulse flows ("Peak magnitude flows"). High pulse flows can have wide-ranging effects on geomorphology and population dynamics on an annual to millennial timescale. Source: Yarnell et al. (2015).



Percentage change in average monthly flow in Putah Creek after implementation of new flow regime accord. More functional pulse flows were restored in the spring, while only increasing overall discharge by 21%. Similar flow regime models could be implemented for parts of the Sacramento River. Source: Kiernan et al. (2012).

VIII. Conclusion

Recommendation: The 2013 Delta Plan provided one outcome performance measure related to flows: "Progress toward restoring in-Delta flows to more natural functional flow patterns to support a healthy estuary. Metrics: results from hydrological monitoring and hydrodynamic modeling (ER R1)." This performance measure has been updated and now contains three specific added sub-performance measures: Yolo Bypass flow patterns, more gradual recession flows at the end of the wet season, and Spring flow pulse. The Spring pulse flow sub-performance measure was added based on new scientific research that highlights the importance of the Spring pulse to native fish communities, riparian zone health, and system geomorphology. The Initial PM should focus on the mainstem of the Sacramento River below Shasta Dam. Monitoring locations could be expanded to incorporate priority tributaries in the future. Spring pulse flow targets should incorporate best available science, and consider SWRCB flow objectives. Related monitoring data conducted by researchers should be used to assess contribution of this measure in monitoring restoration components of the coequal goals and refine targets over time.

Justification: The initial performance measure was updated to measure specific variables directly related to a healthier river tributary and estuary. This sub-performance measure now identifies a specific variable, Spring flow pulse, and relates this to expected outcomes in the Sacramento River. Spring pulse flows help monitor progress towards restoring the ecological health of the lower Sacramento River and the Delta. Spring pulse flows can be quantified using discharge data that is already monitored for multiple stations along the lower Sacramento River below Shasta Dam as well as priority tributaries. Quantifying and reporting on Spring pulse flows will allow Council staff to measure progress towards restoring more natural functional flows.

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